OVERVIEW OF ENDOSULFAN RISK ASSESSMENT

July 26, 2001

Introduction

This document summarizes EPA's human health, environmental fate and transport, and ecological risk findings for the dioxathiepin pesticide endosulfan, (broadly classified as an organochlorine) as presented fully in the documents, "Endosulfan: HED Risk Assessment for the Endosulfan Reregistration Eligibility Decision (RED)," dated January 31, 2001 and "Revised EFED Risk Assessment for the Reregistration Eligibility Decision on Endosulfan," dated April 13, 2001. The purpose of this overview is to assist the reader by identifying the key features and findings of these risk assessments, and to better understand the conclusions reached in the assessments. References to relevant sections in the complete documents are provided to allow the reader to find the place in these assessments where a more detailed explanation is provided. This overview was developed in response to comments and requests from the public which indicated that the risk assessments were difficult to understand, that they were too lengthy, and that it was not easy to compare the assessments for different chemicals due to the use of different formats.

These endosulfan risk assessments and additional supporting documents, are posted on EPA's Internet website (http://www.epa.gov/pesticides/endosulfan.htm) and are available in the Pesticide Docket for public viewing. Meetings with stakeholders (i.e., growers, extension officials, commodity group representatives and other government officials) will be held to discuss the risk assessments, the identified risks and solicit input on risk mitigation strategies, if needed. This feedback will be used to complete the Reregistration Eligibility Decision (RED) document, which will include the resulting risk management decisions. The Agency plans to conduct a close-out conference call with interested stakeholders to describe the regulatory decisions presented in the RED.

Risks summarized in this document are those that result only from the use of endosulfan. The Food Quality Protection Act (FQPA) requires that the Agency consider "available information" concerning the cumulative effects of a particular pesticide's residues and "other substances that have a common mechanism of toxicity." The reason for consideration of other substances is due to the possibility that low-level exposures to multiple chemical substances that cause a common toxic effect by a common mechanism could lead to the same adverse health effect as would a higher level of exposure to any of the other substances individually. The Agency did not perform a cumulative risk assessment as part of this reregistration review of endosulfan because the Agency has not yet initiated a review to determine if there are any other chemical substances that have a mechanism of toxicity common with that of endosulfan. If the Agency identifies other substances that share a common mechanism of toxicity with endosulfan, then a cumulative risk assessment will be conducted that includes endosulfan once the final framework the Agency will use for conducting cumulative risk assessments is available. Further,

the Agency is in the process of developing criteria for characterizing and testing endocrine disrupting chemicals and plans to implement an Endocrine Disruptor Screening Program in 2001. Endosulfan will be reevaluated at that time and additional testing may be required.

Use Profile

- **Insecticide/Acaracide:** Registered for use on the following crops/sites: alfalfa (seed only), barley, beans (dry and succulent), blueberries, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, celery, clover (seed only), collards, cotton, kale, corn (fresh only), cucumbers, eggplants, grapes, peppers, oats, lettuce, kohlrabi (seed only), melons, mustard greens, pineapples, rye, potatoes, pumpkins, raddish (seed only), rutabaga (seed only), spinach, squash, sweet potatoes, strawberries, tobacco, tomato, turnip and wheat, apples, apricots, almonds, cherries, filberts, macadamia nuts, nectarines, pecans, pears, plums, prunes, walnuts, shade trees, shrubs, citrus (non-bearing), nursery stock, Christmas tree plantations, woody plants, peaches (root dip only) and ornamental trees and shrubs.

- **Formulations:** Formulated as a liquid emulsifiable concentrate (9-34% ai) and wettable powder (1-50% ai). The wettable powder formulation is frequently packaged in water soluble bags.

- **Methods of Application:** Endosulfan may be applied by groundboom sprayer, fixed-wing aircraft, chemigation (potatoes only), airblast sprayer, rights of way sprayer, low and high pressure handwand, backpack sprayer and dip treatment.

- **Use Rates:** Maximum application rates range from 0.5 lb ai/A to 7.5 lb ai/A (pecans and macadamia nuts). The number of maximum allowable applications on the majority of labels ranges between 1 and 3 per season or year, but does not exceed 6.

- **Annual Poundage:** Estimates for total annual domestic use averages approximately 1.4 million pounds of active ingredient. Crops with the highest percent crop treated are squash (40%), cantaloupe (31%), pumpkins (20%). In terms of pounds applied, pecans (20%), honeydew (19%), strawberries (14%) account for the greatest agricultural use. As much as 6% of endosulfan is believed to be applied by horticultural nurseries in greenhouses.

- **Registrants:** Aventis CropScience, Makhteshim-Agan of North America, FMC Corporation, Platte Chemical, and Drexel Company.

Human Health Risk Assessment

Acute Dietary (Food) Risk

(For a complete discussion, see section 4.2 of the Human Health Risk Assessment)

Acute dietary risk is calculated considering foods eaten in one day (consumption) and endosulfan residue values in or on the food eaten by the general population and each population subgroup of interest. The consumption distribution can either be multiplied by a residue point estimate for a deterministic-type (i.e., Tier I/II) exposure assessment, or used with a residue distribution in a Tier III probabilistic-type (Monte Carlo) exposure assessment. A risk estimate that is less than 100% of the acute Population Adjusted Dose (aPAD) (the dose at which an individual could be exposed on any given day that would not be expected to result in adverse health effects) does not exceed the Agency's level of concern.

The Agency performed a revised probabilistic Tier 3 (Monte-Carlo) acute dietary exposure assessment to estimate the dietary risks associated with the registration of endosulfan. New weighting procedures for using FDA surveillance monitoring data in Tier 3 acute and chronic dietary exposure analyses for risk assessment purposes were recently developed. The approach to using these data varies according to the specific chemical. In the case of endosulfan, domestic and imported crops were considered separately. This procedure permits data which has been collected in a manner that does not reflect the proper proportion of domestic vs. imported samples to be adjusted so that more realistic Tier 3 exposure estimates are developed. If there are significant differences between domestic and imported samples (either in terms of likelihood of detected residues or residue levels themselves), then the Agency found it necessary to "weight" the FDA data since it would better reflect the proportionate domestic and foreign produce that the US population consumes.

Acute risk estimates from exposures to food, associated with the use of endosulfan do not exceed the Agency's level of concern. This assessment uses statistical methodology for applying existing information to acute dietary risk assessments. The estimated acute dietary (food only) risk is 70% of the aPAD without using weighted FDA data, and 51% of the aPAD using weighted FDA data, at the 99.9^{th} percentile for the most highly exposed population subgroup, children ages 1-6 years of age.

TABLE 1: Tier 3 Acute Dietary Food Exposures as a Percentage of the Acute PAD (% aPAD)

Population Sub-Group	99.9th Percentile Weighted Data	99.9th Percentile Unweighted Data
U.S. Population	9%	13%
All Infants	31%	36%
Children 1-6	**51%**	**70%**
Children 7-12	35%	46%
Females 13 -50	31%	23%

- The Dietary Exposure Evaluation Model (DEEM™) was used to estimate acute dietary exposures from consumption of foods that contain endosulfan residues.

- Endosulfan residues may be either concentrated or reduced by the activities of drying (prunes etc.), processing (juice, catsup, etc.), washing, peeling, and cooking. Since processing data were limited, the Dietary Exposure Evaluation Model (DEEM™) default factors were used in this assessment for most commodities. Acceptable chemical-specific processing data were used for apples, cotton seed, grapes, pineapples, potatoes and tomatoes.

- The toxicological endpoint selected for the acute dietary assessment is based on increased incidences of convulsions from the acute neurotoxicity study in rats (NOAEL= 1.5 mg/kg/day) where convulsions were observed within 8 hours after a single dose in female rats at 3 mg/kg/day (LOAEL).

- The uncertainty Factor is 100x;10x to account for interspecies extrapolation and10x to account for intraspecies variability.

- A FQPA Safety Factor of 3x was retained for all population subgroups that include infants and children and females 13-50 years old. This was necessary because of uncertainty regarding the effects on the developing fetal nervous system resulting from the lack of subchronic and developmental neurotoxicity studies. The exposure data used in the assessment are adequate such that the Agency believes that exposures have not been underestimated.

- The Acute dietary RfD is 0.015 mg/kg/day and the aPAD (acute population adjusted dose) is 0.005 mg/kg/day for infants, children and females 13-50 years old and 0.015 mg/kg for all other population subgroups.

Chronic Dietary (Food) Risk

(For a complete discussion, see section 4.2 of the Human Health Risk Assessment)

Chronic dietary risk is calculated by using the average consumption value for food and average residue values on those foods over a 70-year lifetime. A risk estimate that is less than 100% of the chronic RfD (the dose at which an individual could be exposed over the course of a lifetime and no adverse health effects would be expected) does not exceed the Agency's level of concern. The cPAD is the chronic reference dose (cRfD) adjusted for the FQPA Safety Factor.

Chronic risk estimates from exposures to food do not exceed the Agency's level of concern. The chronic dietary (food only) risk estimate is 6% of the cPAD, without using weighted FDA data, for the most highly exposed population subgroup, children ages 1-6 years old. The Agency also conducted chronic risk estimates using FDA weighted data and the results were not substantially different.

TABLE 2: Tier 3 Chronic Dietary Food Exposures as a Percentage of the Chronic PAD (% cPAD)

Population Sub-Group	% Chronic PAD
U.S. Population	<1%
All Infants (<1 year)	3%
Children 1-6	**6%**
Children 7-12	4%
Females 13 - 50	2%

- The toxicity endpoint for the chronic dietary assessment is reduced body weight gain and increased incidences of kidney lesions and blood vessel aneurysms based on the results of a two-year chronic toxicity study in rats (NOAEL = 0.6 mg/kg/day). These effects were observed at 2.9 mg/kg/day (LOAEL).

- The uncertainty factor is100x;10x for inter-species variation and 10x for intra-species extrapolation. The 10x FQPA Safety Factor was reduced to 3x as in the acute assessment.

- The chronic RfD is calculated to be 0.006 mg/kg/day. The cPAD (chronic population adjusted dose) is 0.002 mg/kg/day for infants, children and females 13-50 years old and 0.006 mg/kg for all other population subgroups

- The available scientific literature suggests that endosulfan may act as a potential endocrine disruptor. *In vivo* studies of amphibians, birds, and mammals and several *in vitro* studies support this observation. Further, the results of several guideline avian reproduction and mammalian toxicity studies found reproductive and/or developmental effects that could be related to the disruption of endocrine-mediated systems.

Drinking Water Dietary Risk

(For a complete discussion, see section 4.3 of the Human Health Risk Assessment)

Drinking water exposure to pesticides can occur through groundwater and surface water contamination. EPA considers both acute (one day) and chronic (lifetime) drinking water risks and uses either modeling or actual monitoring data, if available, to estimate those risks. To determine the maximum allowable contribution of treated water allowed in the diet, EPA first looks at how much of the overall allowable risk is contributed by food, then calculates a "drinking water level of comparison" (DWLOC) to determine whether modeled or monitoring levels exceed this level.

The Agency uses a DWLOC as a surrogate to capture risk associated with exposure from pesticides in drinking water. The DWLOCs represent the maximum contribution to the human diet (in ppb or µg/L) that may be attributed to residues of a pesticide in drinking water after dietary exposure is subtracted from the aPAD or cPAD. Risks from drinking water are assessed by comparing the DWLOCs to the estimated environmental concentrations (EECs) in surface

water and groundwater. Drinking water modeling is considered to be an unrefined assessment and provides high-end estimates. In this case, the Agency concludes that no population group is exposed to endosulfan residues in drinking water at a level that poses an acute or chronic risk of concern. That is, EEC levels for all populations do not exceed DWLOC levels.

Table 3: Tier 3 Drinking Water Levels of Concern (Using Weighted and Unweighted FDA Data) for Acute Dietary Exposure

Population Subgroup	Surface Water Estimated Concentrations (ppb)	Ground Water Estimated Concentrations (ppb)	Acute DWLOC (ppb) Weighted	Acute DWLOC (ppb) Unweighted
U.S. Population	8.1	0.012	477	459
All Infants (<1 years)			35	32
Children (1 - 6 years)			25	15
Females (13 - 50 years)			115	103

Table 4: Tier 3 Drinking Water Levels of Comparison (Using Weighted and Unweighted FDA Data) for Chronic Dietary Exposure

Population Subgroup	Surface Water Estimated Concentrations (ppb)	Ground Water Estimated Concentrations (ppb)	Chronic DWLOC (ppb)
U.S. Population	1.3	0.012	208
All Infants (<1 years)			19
Children (1 - 6 years)			19
Females (13 - 50 years)			59

- Estimated drinking water concentrations for ground water are based on the SCI-GROW model, which is a conservative, Tier I assessment that provides a high-end estimate.

- Estimated drinking water concentrations for surface water are based on the PRZM-EXAMS model, which is a refined Tier-II assessment that provides a high-end estimate.

- For acute risk, potential exposure to endosulfan from drinking water derived from surface water does not exceed the Agency's level of concern. A surface water acute EEC of 8.1 ppb does not exceed the calculated (unweighted and weighted) DWLOCs of 15 and 25 for children, 1- 6 years old, the most highly exposed subgroup.

- For chronic risk, potential exposure to endosulfan from drinking water derived from surface water results in a chronic EEC of 1.3 ppb, which does not exceed the DWLOC of 19 for children, 1-6 years old, the most highly exposed subgroups.
- The acute and chronic groundwater EEC for endosulfan is 0.012 ppb, which does not exceed the DWLOCs of 15 ppb (acute - unweighted), or 25 ppb (acute weighted) or 19 ppb (chronic).

Residential Risk

(For a complete discussion, see section 4.4 of the Human Health Risk Assessment)

Voluntary cancellation of residential uses was requested by members of the Endosulfan Task Force (ETF) and these requests have followed and completed the Agency's 6(f) comment process. The members of the Task Force are also not supporting dust or smoke canister uses, or any uses of endosulfan in or around the home, around public buildings or recreational areas where children might be exposed. Therefore, the Agency did not include the affected non-agricultural and residential uses in its revised risk assessment.

The Agency is currently in the process of expanding the scope of the residential exposure assessments by developing guidance for characterizing exposures from sources other than residential uses such as from spray drift, residential residue track-in, exposures to farm worker children, and exposures to children in schools. Modifications to this assessment will be incorporated as updated guidance becomes available.

Aggregate Risk

(For a complete discussion, see section 5.0 of the Human Health Risk Assessment)

The aggregate risk assessment for endosulfan examines the combined risk from exposure through food and drinking water. As mentioned above, the Task Force is not supporting residential uses for reregistration. As a result, they were not included in this assessment. Generally, combined risks from these exposures that are less than 100% of the aPAD and cPAD are not considered to be a risk concern. Exposures to endosulfan from dietary (food and water) sources are not of concern.

The Agency has concluded with reasonable certainty that no harm to any population will result from either acute or chronic dietary (food and water) exposure to endosulfan residues. DWLOCs that correspond to potential acute and chronic consumption of water by the general population and specific population subgroups (i.e., infants, children, and females of childbearing age) were compared to the EECs. The calculated DWLOCs for all populations are greater than the surface water peak and chronic EECs, and the ground water EECs. Therefore, when considered along with exposure from consumption of foods containing residues of endosulfan, potential drinking water exposures are not expected to result in aggregate risks of concern.

Occupational Risk

(For a complete discussion, see section 7.0 of the Human Health Risk Assessment)

People can be exposed to a pesticide while working through mixing, loading, or applying a pesticide, and reentering a treated site. Handler and worker risks are measured by a Margin of Exposure (MOE) which determine how close the occupational exposure comes to a No Observed Adverse Effect Level (NOAEL) taken from animal studies. Generally, MOEs greater than 100

do not exceed the Agency's level of concern. For workers entering a treated site, Restricted Entry Intervals (REIs) are calculated to determine the minimum length of time required before workers or others are allowed to re-enter.

- For short-term and intermediate-term dermal toxicity endpoints, the NOAEL of 3 mg/kg/day was based on increased mortality and liver abnormalities. The LOAEL of 9 mg/kg/day was selected from a 21-day dermal toxicity in rats study.

- For the short-term and intermediate-term inhalation toxicity endpoints a NOAEL of 0.001 mg/L was selected based on decreased body weight gain (males), decreased leukocyte counts (males) and increased creatinine levels (females) seen at the LOAEL or 0.0020 mg/L in a 21-day inhalation rat study.

- An additional 3x uncertainty factor was added to the standard 100x uncertainty factor for the intermediate and long-term scenarios due to the lack of a long-term study and evidence from long-term oral studies that the severity of the toxicity noted in the 21-day study could be expected to increase with duration of exposure

Occupational Handler Summary

Dermal and inhalation risks for handlers were assessed separately since the end effects for the toxicological endpoints chosen for these exposures are dissimilar and Agency policy is to not aggregate the risks (inhalation plus dermal) if the toxicological effects are not the same. Handler exposures to endosulfan are expected to be short-term only (1 - 30 days) because of the types of crops on which endosulfan is used and the availability of a 21-day dermal toxicity study to assess the risks.

Of the 21 identified occupational handler exposure scenarios, 12 of them are a risk of concern, having calculated MOEs less than the target MOE of 100, at the highest level of mitigation for **short-term dermal** exposure. For **short-term inhalation** exposure, 4 of the 21 identified occupational handler exposure scenarios are a risk of concern, having calculated MOEs less than the target MOE of 100, at the highest level of mitigation. Some of the scenarios which are risks of concern are based on low level confidence level. See paragraph below for a more detailed discussion.

Three scenarios lack data to assess their risk. Data are needed to assess the following occupational handler scenarios: applying dip treatments to trees and roots or whole plants and mixing/loading/applying wettable powders with a backpack sprayer and a high pressure handwand.

Data quality and confidence in the assessment are important issues that must be considered when interpreting the occupational exposure risk assessment. These include:

- Generic protection factors (PF) were used to calculate handler exposures (e.g., 90 percent PF over baseline for inhalation unit exposure to account for use of an organic vapor removing respirator).

- Low confidence data, based on PHED grading criteria, were used to calculate the risks to handlers from the following scenarios for any body part and/or level of mitigation: Mixing/loading wettable powders, applying sprays with an airblast sprayer (enclosed cabs), applying sprays with a rights of way sprayer, mixing/loading/applying liquids and wettable powders with a low pressure handwand, mixing/loading/applying liquids with a high pressure handwand and backpack sprayer, and flagging aerial applications.

Handler Risk Scenarios

- No acceptable chemical-specific exposure studies were available for the occupational assessment.

- Surrogate-based exposure assessments for each scenario were developed, where appropriate, using the Pesticide Handler Exposure Database (PHED).

- On current endosulfan labels, personal protective equipment (PPE) requirements range from no PPE listed to long sleeved shirt and long pants, waterproof gloves, shoes, socks, chemical resistant headgear, respirator with either an organic vapor removing cartridge with a prefilter or canister approved for pesticides. Mixers and loaders must also wear a chemical resistant apron.

- Handler exposure assessments were completed using a baseline exposure scenario and, if required, increasing levels of risk mitigation (PPE and engineering controls) in an attempt to achieve an appropriate margin of exposure. The baseline scenario generally represents a handler wearing long pants, a long-sleeved shirt, socks and shoes, no respirator, and no chemical-resistant gloves (there are exceptions pertaining to the use of gloves).

- The additional PPE scenario generally represents a handler wearing long pants, long-sleeved shirt, socks, shoes, coveralls, chemical resistant gloves and an organic vapor respirator.

- The engineering controls scenario represents a handler wearing long pants, long sleeved shirt, socks, shoes, chemical resistant gloves (airblast only) and using enclosed mixing/ loading systems and on enclosed cab, truck or cockpit.

Table 5. Summary of Short Term Occupational Handler Risks to Endosulfan

Exposure Scenario (Scenario #)	Crop Type/Use[a]	Range of Application Rates (lb ai/A)[b]	Amount Handled per Day[c]	Additional PPE		Engineering Controls	
				Dermal MOE	Inhalation MOE	Dermal MOE	Inhalation MOE
Mixer/Loader Exposures							
Mixing/Loading Liquid Formulations for Aerial Application (1a)	clover	0.5 lb ai/A	350 Acres	71	670	140	-
	tobacco	2.5 lb ai/A	350 Acres	14	130	**28**	-
	pecans	7.5 lb ai/A	350 Acres	5	44	**10**	**64**
	small grains	0.75 lb ai/A	1200 Acres	14	130	**27**	-
	cotton	1.5 lb ai/A	1200 Acres	7	65	**14**	**94**
Mixing/Loading Liquid Formulation for Chemigation (1b)	potatoes (Idaho)	1.0 lb ai/A	350 Acres	35	330	**70**	-
Mixing/Loading Liquid Formulations for Groundboom Application (1c)	clover	0.5 lb ai/A	80 Acres	310	-	-	-
	tobacco	2.5 lb ai/A	80 Acres	62	580	120	-
	small grains	0.75 lb ai/A	200 Acres	82	780	160	-
	cotton	1.5 lb ai/A	200 Acres	41	390	**81**	-
Mixing/Loading Liquid Formulations for Airblast Application (1d)	Ornamental Trees/Shrubs	1.0 lb ai/A	40 Acres	310	-	-	-
	hazelnuts	2.0 lb ai/A	40 Acres	150	-	-	-
	pecans	7.5 lb ai/A	40 Acres	41	390	**81**	-
Mixing/Loading Liquids for Rights of Way Spray Application (1e)	grapes	0.005 lb ai/gal	1000 Gallons	2500	-	-	-
	cherry	0.04 lb ai/gal	1000 Gallons	310	-	-	-
Mixing/Loading Liquids for Plant and Root Dip (1f)	cherry, peach and plums	0.05 lbs ai/gal	100 Gallons	2500	-	-	-
Mixing/Loading Wettable Powders for Aerial Application (2a)	beans	1.0 lb ai/A	350 Acres	5	10	**61**	170
	sweet potato	2.0 lb ai/A	350 Acres	2	5	**31**	**83**
	peach	3.0 lb ai/A	350 Acres	1.5	3	**20**	**56**
	small grains	0.75 lb ai/A	1200 Acres	2	4	**24**	**65**
	cotton	1.5 lb ai/A	1200 Acres	1	2	**12**	**32**

Exposure Scenario (Scenario #)	Crop Type/Use[a]	Range of Application Rates (lb ai/A)[b]	Amount Handled per Day[c]	Additional PPE		Engineering Controls	
				Dermal MOE	Inhalation MOE	Dermal MOE	Inhalation MOE
Mixing/Loading Wettable Powders for Groundboom Application (2b)	beans	1.0 lb ai/A	80 Acres	20	41	270	730
	sweet potato	2.0 lb ai/A	80 Acres	10	20	130	360
	small grains	0.75 lb ai/A	200 Acres	11	22	140	390
	cotton	1.5 lb ai/A	200 Acres	5	11	**71**	190
Mixing/Loading Wettable Powders for Airblast Application (2c)	ornamental trees/shrubs	1.0 lb ai/A	40 Acres	40	81	540	1500
	hazelnuts	2.0 lb ai/A	40 Acres	20	41	270	730
	peaches	3.0 lb ai/A	40 Acres	13	27	270	490
Mixing/Loading Wettable Powders for Rights of Way Spray Treatment (2d)	grapes	0.005 lb ai/gal	1000 Gallons	320	650	-	-
	walnut	0.02 lb ai/gal	1000 Gallons	81	160	1100	-
Mixing/Loading Wettable Powders for Plants and Root Dip (2e)	cherry, peach, and plum	0.05 lb ai/gal	100 Gallons	320	650	-	-
Applicator Exposures							
Applying Spray with Aerial Equipment (3)	clover	0.5 lb ai/A	350 Acres	See Eng. Controls	See Eng. Controls	240	1200
	tobacco	2.5 lb ai/A	350 Acres			**48**	240
	pecans	7.5 lb ai/A	350 Acres			**16**	**78**
	small grains	0.75 lb ai/A	1200 Acres			**47**	230
	cotton	1.5 lb ai/A	1200 Acres			**23**	110
Applying Sprays with a Groundboom Sprayer (4)	clover	0.5 lb ai/A	80 Acres	-	-	-	-
	tobacco	2.5 lb ai/A	80 Acres	95	950	210	-
	small grains	0.75 lb ai/A	200 Acres	-	-	-	-
	cotton	1.5 lb ai/A	200 Acres	64	630	140	-
Applying Sprays with an Airblast Sprayer (5)	ornamental trees	1.0 lb ai/A	40 Acres	24	780	280	-
	hazelnuts	2.0 lb ai/A	40 Acres	12	390	140	-
	pecans	7.5 lb ai/A	40 acres	3	100	**37**	-

Exposure Scenario (Scenario #)	Crop Type/Use[a]	Range of Application Rates (lb ai/A)[b]	Amount Handled per Day[c]	Additional PPE		Engineering Controls	
				Dermal MOE	Inhalation MOE	Dermal MOE	Inhalation MOE
Applying Sprays with a Rights of Way Sprayer (6)	grapes	0.005 lb ai/gal	1000 Gallons	140	-	NA	NA
	cherries	0.04 lb ai/gal	1000 Gallons	**18**	900	NA	NA
Applying Dip Treatment to Roots, or Whole Plants (7)	cherry, peach, plum roots	0.05 lb ai/gal	100 Gallons	No Data	No Data	ND	ND
Mixer/Loader/Applicator Exposure							
Mixing/Loading/Applying Liquid Formulations with a Low Pressure Handwand (8)	tobacco (drench)	0.005 lb ai/gal	40 Gallons	2800	-	NA	NA
	tomato (greenhouse)	0.01 lb ai/gal	40 Gallons	1400	-	NA	NA
	cherries	0.04 lb ai/A	40 Gallons	350	-	NA	NA
Mixing/Loading/Applying Wettable Powders with a Low Pressure Handwand (9)	tomato/ tobacco	0.005 lb ai/gal	40 Gallons	170	640	NA	NA
	walnut	0.02 lb ai/gal	40 Gallons	**42**	160	NA	NA
Mixing/Loading/Applying Liquid with a High Pressure Handwand (10)	tobacco (drench)	0.005 lb ai/gal	1000 Gallons	**26**	230	NA	NA
	tomato (greenhouse)	0.01 lb ai/gal	1000 Gallons	**13**	120	NA	NA
	cherries	0.04 lb ai/A	1000 Gallons	**3**	**29**	NA	NA
Mixing/Loading/Applying Liquid with Backpack Sprayer (11)	tobacco (drench)	0.025 lb ai/gal	40 Gallons	-	-	NA	NA
	tomato (greenhouse)	0.01 lb ai/gal	40 Gallons	-	-	NA	NA
	cherries	0.04 lb ai/A	40 Gallons	**82**	-	NA	NA
Flagger Exposures							
Flagging Aerial Spray Applications (12)	clover	0.5 lb ai/A	350 Acres	-	-	-	-
	tobacco	2.5 lb ai/A	350 Acres	24	460	1100	-
	pecans	7.5 lb ai/A	350 Acres	8	150	360	-

a Crops named are index crops which are chosen to represent all other crops at or near that application rate for that use. See the application rates listing in the use summary section of this document for further information on application rates used in this assessment.

b Application Rates are based on the maximum application rates listed on the endosulfan labels.

c Amount handled per day are from Science Advisory Council on Exposure's Policy # 9.

NF = Not feasible for this scenario (no available engineering controls).ND = No data.

Bolded MOE values show a risk of concern at the highest possible level of mitigation for the corresponding scenario.

Post-Application Occupational Risk

The Agency has determined that there are potential short- and intermediate-term postapplication dermal exposures to individuals entering treated fields. Current labels show a restricted entry interval (REI) requirement of 24 hours with the following early entry PPE required: coveralls, waterproof gloves, shoes, socks and chemical resistant headgear for overhead exposures.

A dose and MOE are determined from the predicted dislogeable foliar residues (DFR) values over time until the target MOE of 100 is reached for every crop for both the emulsifiable concentration and wettable powder formulations. For this assessment, crops were grouped together in order to assign the most representative DFR data to the crops.

- Endosulfan use patterns show short-term (1-30 days) and intermediate-term (1 month to 6 months) dermal exposure is possible for post-application exposures. Therefore, risk estimates were calculated for both short-term and intermediate-term scenarios.

- For short term worker re-entry risk, the calculated REI represents the day on which the MOE is greater than or equal to 100. For intermediate worker re-entry risk, the calculated REI represents the day on which average residues result in an MOE greater than or equal to 300.

- Chemical-specific DFR data were available for endosulfan, which evaluated dislodgeable residue dissipation for endosulfan applied to peaches, grapes, and melons.

- The crop groups were chosen because appropriate surrogate residue data were available. For tree crops, the Agency used DFR data for peaches; for grape harvesting, girdling and irrigating, DFR data for grapes were used. For field crops, DFR data for melons were used and assumed to be representative of exposure from postapplication activities associated with all remaining crops registered for endosulfan.

- The REIs presented in the table below represent the day on which the MOE is equal to or greater than 100. During the risk management phase of the process, MOEs will be calculated for other potential REIs that reflect what is believed to be feasible from the perspective of stakeholders, if necessary. This will enable the Agency to further characterize the potential risks associated with post application exposures.

Table 6. Summary of Post-application Exposure.

Crop[a]	Activity[d]	Short-term Exposure		Intermediate-term Exposure	
		Day after Application When MOE $100[e]		First day of Decline Period When MOE $300[f]	
		WP[b]	EC[c]	WP[b]	EC[c]
Table Grapes / Raisins	Cane turning and tying, and girdling	49	17	**52**	17
Juice Grapes	Tying, training, hand harvesting, hand pruning, and thinning.	39	11	**42**	11
Grapes, Table and Juice	Scouting and irrigating	17	0	**20**	0
Apple, Apricot, Cherry, Nectarines, Peach, Pear, Plum, Prune, and Christmas Trees.	Thinning, staking, topping, training, and hand harvest	30	17	30	17
Ornamental Trees / Shrubs including Evergreen Trees and Non-bearing Citrus Trees.	Hand pruning and seed cone harvesting	20	6	20	6

Crop[a]	Activity[d]	Short-term Exposure		Intermediate-term Exposure	
		Day after Application When MOE $100[e]		First day of Decline Period When MOE $300[f]	
		WP[b]	EC[c]	WP[b]	EC[c]
Apple, Apricot, Cherry, Nectarines, Peach, Pear, Plum, Prune, Ornamental Trees / Shrubs including Evergreen Trees, Non-bearing Citrus Trees and Christmas Trees.	Scouting and irrigating	8	0	8	0
Macadamia nuts and Pecans	Hand harvesting, pruning, and thinning	NA	14	NA	**18**
	Scouting and irrigating	NA	0	NA	0
Hazelnut, Almonds and Walnut	Hand harvesting and pruning	14	2	14	**7**
	Scouting and irrigating	0	0	0	0
Blueberries, Kohlrabi, Broccoli, and Cabbage.	Hand harvesting, pruning, thinning, and irrigating.	24	20	24	20
Kohlrabi, Broccoli, and Cabbage.	Scouting and irrigating	22	19	22	19
Blueberries	Scouting and irrigating	12	8	12	8
Brussel Sprouts and Cauliflower	Topping, irrigating, hand harvesting, and tying.	19	15	19	15
	Scouting and irrigating	17	13	17	13
Corn	Detassling	31	28	31	28
	Scouting and irrigating	10	5	10	5
Cucumber, Melons, Pumpkin, Squash, Beans, Peas, Celery, Lettuce, Spinach, and Carrots.	Hand harvesting, pruning, thinning, turning, and leaf pulling	14	9	14	9
Alfalfa, Barley , Clover, Oats, Rye, Wheat, White Potatoes, Cucumber, Melon, Pumpkin, Squash, Bean, Peas, Celery, Lettuce, and Spinach.	Scouting and irrigating	10	5	10	5
Carrots	Scouting and irrigating	0	0	0	0
Pepper, Eggplant, and Tomato	Hand harvesting, staking, tying, pruning, thinning, and training.	8	2	8	2
	Scouting and irrigating	5	0	5	0
Pineapple	Hand harvesting	12	8	12	8
	Scouting and irrigating	7	2	7	2
Strawberry	Hand harvesting, pinching, pruning, and training.	15	13	15	13
	Scouting and irrigating	6	2	6	2
Cotton, Collard Greens, Kale, Mustard Greens, Sweet Potato, Radish, Rutabaga, and Turnip.	Hand harvesting, pruning, and thinning.	18	15	18	15
Cotton, Collard Greens, Kale, Mustard Greens and Sweet Potato.	Scouting and irrigating	15	11	15	11
Radish, Rutabaga, and Turnip.	Scouting and irrigating	4	0	4	0
Tobacco	Hand harvesting, pruning, striping, thinning, topping, and hand weeding	15	16	15	16
	Scouting and irrigating	12	13	12	13

Footnotes:

NA = Not applicable (formulation use does not exist for the crop)

a Crops were grouped according to similar application rates, transfer coefficients, and surrogate DFR data sources.

b WP = wettable powder formulation

c EC = emulsifiable concentrate formulation

d Activities are from Science Advisory Council on Exposure Policy 3.1.[17] Each activity many not occur for every crop listed in group.

e Day after application when the calculated MOE is greater than the target MOE of 100. The short-term target MOE of 100.

f First day of decline period (30 days) when average residues result in an MOE > 300, which would be the first day that would not have a risk of concern. Bolded values denote when intermediate-term DAT not resulting in a risk of concern is different than short term DAT not resulting in a risk of concern..

Ecological Risk

To estimate potential ecological risk, EPA integrates the results of exposure and ecotoxicity studies using the quotient method. Risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic, for various wildlife species. RQs are then compared to levels of concern (LOCs). Generally, the higher the RQ, the greater the potential risk. Risk characterization provides further information on the likelihood of adverse effect occurring by considering the fate of the chemical in the environment, communities and species potentially at risk, their spatial and temporal distributions and the nature of the effects observed in studies.

Environmental Fate and Transport

Based on the environmental fate properties of each isomer (α- and β-endosulfan), technical grade endosulfan represents a mixture of two chemically distinct pesticides which differ in persistence and volatility. Both isomers of endosulfan (α- and β) are acutely toxic. Endosulfan is persistent and prevalent in the environment. Monitoring studies confirm residues in the soil, water and air. Endosulfan binds to sediments and is not expected to be mobile. However, because of the compound's persistence, endosulfan is likely to access surface waters via runoff, and ground water because of its persistence. It is a semivolatile compound that has been detected in nearly all environmental compartments, including surface- and ground-water and in locations where it is not used possibly as a result of atmospheric transport.

- The end-use product is a mixture of two endosulfan isomers, typically 70% "-endosulfan and 30% $-endosulfan. The $-isomer is generally more persistent and the "-isomer is more volatile. For both isomers, hydrolysis at pH values greater than 7 is an important degradation route; however, at pH values below 7, both isomers are persistent. The major degradate product of α- and β-endosulfan is endosulfan sulfate, which is as toxic as the parent endosulfan.

- At pH 7, "-endosulfan and $-endosulfan hydrolyze with half-lives of 11 and 19 days, respectively, and at pH 9, the isomers have half-lives of 4 to 6 hours. Under acidic conditions, both isomers are stable to hydrolysis, and microbial degradation in soils becomes the predominant route of degradation. Half-lives in acidic to neutral soils range from one to two months for "-endosulfan and from three to nine months for $-endosulfan under aerobic conditions.

- Dissipation rates observed in field studies suggest that endosulfan will persist in the surface soil for weeks to months after application.

- Laboratory studies indicate that "- and $-endosulfan have a high affinity for sorption onto soil and are not expected to be highly mobile in the soil environment.

- Endosulfan can persist long enough to be transported to both surface- and ground waters, despite its low mobility as monitoring studies have shown, because of its resistance to degradation.

- Endosulfan can contaminate surface waters through spray drift and transport in runoff. In addition, endosulfan may move to targets beyond its use area through atmospheric transport.

- Within water bodies, endosulfan tends to be sorbed onto sediment and plants. The sorbed endosulfan may be slowly released back into the water.

- As mentioned in the human health section above, a review of the available literature suggests that endosulfan may act as a potential endocrine disruptor.

Nontarget Terrestrial Organism Risk

- Avian RQs exceed levels of concern for acute and chronic exposures at current application rates. Acute RQs range from 0.02 - 8.9 and chronic RQs range from 0.03 - 2.7.

- Mammalian RQs exceed levels of concern for chronic exposures. Chronic RQ values range from 0.3 - 5.4.

Nontarget Aquatic Organism Risk

- Freshwater invertebrate RQs exceed levels of concern for acute exposures. Acute RQ values range from 0.17 - 3.3 for freshwater invertebrates. Chronic RQs range from 5.6 - 93.

- Freshwater fish acute RQ values range from 1.2 - 23 and chronic RQ values range from 2.2 - 44. Estuarine/marine fish and invertebrates RQs exceed levels of concern for acute and chronic exposures. Acute RQ values range from 9.8 -191 for estuarine/marine fish and 2.2 - 42 for invertebrates. Chronic RQ values range from 24 - 487 for estuarine/marine fish and 7.8 - 130 for estuarine/marine invertebrates.

Probabilistic Assessment of Aquatic Risk

- The Agency conducted a probabilistic assessment to refine risk estimates for aquatic species based on actual reported application rates in California coupled with a 300-ft spray drift buffer.

- The risk assessment projects that for the most vulnerable crop (tomatoes), the use of endosulfan at typical rates resulted in a 90% probability that 60% of aquatic species would experience mortality.

- The risk assessment projects that for the least vulnerable crop (apples), the use of endosulfan at typical rates resulted in a 10% probability of resulting in mortality to 10% of the aquatic species.

- The distribution of freshwater fish LC_{50} values over the distribution of peak EEC values were used to determine the probability of exceeding acute high risk LOCs.

- On all but one of the crops modeled, RQ values would exceed acute high risk LOCs 99% of the time.

Incident Data

- Incident data confirm the potential for impacts on terrestrial and aquatic organisms. Endosulfan is among the most frequently reported cause of aquatic incidents for pesticides.

- Based on EPA's Ecological Incident Information system (EIIS), the cyclodiene class of insecticides accounted for the third highest percentage of incidents (5% of the reported incidents) since 1971.

- There have been 91 reported aquatic incidents since 1971 involving endosulfan. Most were fish kills in addition to some macroinvertebrate incidents.

- Frequency of these incidents has not significantly diminished even after mitigation was implemented (300 ft spray buffer) indicating this is likely a runoff issue. Most reports were from CA. LA, NC and SC.

Summary of Pending Data

The Agency expects to receive endosulfan subchronic and developmental neurotoxicity studies from the Endosulfan Task Force once they have been completed.

Attachment 1: Anticipated Residues and Residue Data Files for Revised Acute Probabilistic Dietary Assessment

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)
Almonds	uncooked, cooked, baked, boiled, dried, frozen	PB	F T	1%	NA	NA	22 detects 2178 zeros 0 @ 0.10 ppm
Apples	uncooked, cooked, baked, boiled, fried	NB	PDP	20%	NA	NA	1000 non-zeros 9091 zeros 1273 @ 0.008 ppm *n=15*
	canned, frozen	PB	PDP				168 detects 1520 zeros 214 @ 0.008 ppm
	juice		PDP				0 detects 1189 zeros 298 @ 0.006 ppm
	dried	B processed	PDP				0.0019
Apricots	uncooked, cooked, boiled	NB	*see peaches*	4%	NA	NA	1000 non-zeros zeros 0 @ 0.003 ppm
	canned, dried, juice	PB					69 detects 4416 zeros 115 @ 0.007 ppm
Barley	uncooked, cooked, baked, boiled, canned, fermented	B (no det. residues)	*see wheat*	1%	NA	NA	0.0001
Beans-*Dry*	cooked, baked, boiled, canned, fried, frozen	B	FDA	3%	<1%	5%	<u>Domestic</u> 3 detects 0 zeros 101@0.003ppm <u>Import</u> 11 detects 0 zeros 269@ 0.003ppm <u>Combined</u> 16 detects 0 zeros 380@0.003ppm
Beans-*Succulent*	Lima: uncooked, cooked, boiled frozen	PB	PDP	5%	NA	NA	308 detects 9754 zeros 205 @ 0.009 ppm

Table continued.

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
	Lima: canned		PDP				2 detects 576 zeros 28 @ 0.008 ppm		
	Lima: frozen		PDP				6 detects 600 zeros 26 @ 0.008 ppm		
	Snap: uncooked, cooked, boiled, cured	PB	PDP	6%	NA	NA	308 detects 1229 zeros 0 @ 0.009 ppm		
	Snap: frozen		PDP				6 detects 594 zeros 31 @ 0.008 ppm		
	Snap Processed: canned	PB	PDP	6%			2 detects 594 zeros 10 @ 0.008 ppm		
Blueberries	uncooked, cooked, baked, boiled, canned, frozen	PB	FDA	6%	<1%	11%	<u>Domestic</u> 1 detect 208 zeros 12@0.003 ppm	<u>Import</u> 0 detects 313 zeros 20@0.003 ppm	<u>Combined</u> 0 detects 313 zeros 20@0.003 ppm
Broccoli	uncooked, cooked, baked, boiled, fried	NB	PDP	26%	NA	NA	5 detects 502 zeros 172@0.009 ppm		
	canned, frozen	PB							
Brussels Sprouts	boiled, frozen	PB	*see lettuce*	10%	NA	NA	145 detects 1863 zeros 62@0.009 ppm		
Cabbage	Fresh: uncooked, cooked, baked, boiled, fried	NB	*see broccoli*	27%	NA	NA	5 detects 461 zeros 166@0.003 ppm		
	Processed: canned, cured	PB		32%			5 detects 668 zeros 310@0.003 ppm		

Table continued.

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
Carrots	uncooked, cooked, baked, boiled	NB	PDP	5%	NA	NA	1000 non-zeros 34908 zeros 837@0.008 ppm *n=29*		
	canned, frozen	PB					52 detects 1780 zeros 43@0.008 ppm		
Cauliflower	uncooked, cooked, boiled, fried	NB	FDA	32%	67%	6%	Domestic 0 detect 69 zeros 32@0.003 ppm	Import 0 detect 18 zeros 38@0.003 ppm	Combined 0 detects 109 zeros 51@ 0.003ppm
	frozen	PB							
Celery	uncooked, cooked, baked, boiled, fried	NB	PDP	11%	NA	NA	1 detects 157 zeros 18@0.009 ppm		
	canned, frozen, juice	PB							
Cherries	Fresh (Sweet): uncooked, cooked, baked, boiled	PB	FDA	8%	<1%	1%	Domestic 14 detect 229 zeros 6@0.003 ppm	Import 0 detect 85 zeros 1@0.003 ppm	Combined 14 detects 308 zeros 13@0.003 ppm
	Processed (Tart): canned, frozen, dried, juice	PB		5%			Domestic 14 detect 135 zeros 0@0.003 ppm	Import 0 detect 85 zeros 1@0.003 ppm	Combined 14 detects 318 zeros 3@0.003 ppm
Collards	boiled, canned, frozen	PB	*see spinach*	17%	NA	NA	215 detects 1865 zeros 167@0.006 ppm		
Corn-*Sweet*	uncooked, cooked, baked, boiled	NB	FDA	1%	<1%	1%	Domestic 1 detect 552 zeros 5@0.003 ppm	Import 0 detect 202 zeros 1@0.003 ppm	Combined 1 detect 754 zeros 7@0.003 ppm
	canned	PB	PDP		NA	NA	1 detect 650 zeros 6@0.003 ppm		
	frozen		PDP				1 detect 643 zeros 5@0.003 ppm		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
Cottonseed-*Meal*	baked	B	FT	4%	NA	NA	0.0006		
Cottonseed-*Oil*	refined	B	FT		NA	NA	0.009		
Cucumbers	uncooked	NB	FDA	27%	19%	40%	<u>Domestic</u> 1000 non-zeros 5054 zeros 869@0.003ppm *n=30*	<u>Import</u> 1000 non-zeros 1310 zeros 0@0.003ppm *n=30*	<u>Combined</u> 1000 non-zeros 2013 zeros 0@0.003 ppm *n=30*
	canned	PB		9%			<u>Domestic</u> 39 detects 231 zeros 0@0.003 ppm	<u>Import</u> 197 detects 258 zeros 0@0.003 ppm	<u>Combined</u> 237 detects 475 zeros 0@0.003 ppm
Eggplant	cooked, baked, boiled, fried	NB	*see tomato*	83%	NA	NA	1000 non-zeros 759 zeros 2705@0.008 ppm		
Filberts	uncooked, baked, boiled	PB	FT	18%	NA	NA	0 detects 27 zeros 6@0.1 ppm		
Grapes	uncooked, cooked, canned, frozen, dried	PB	PDP	6%	NA	NA	95 detects 1771 zeros 18@0.008 ppm		
	juice		PDP				0 detects 544 zeros 35@0.010 ppm		
Ground Cherries	ground cherries	NB	*see tomatoes*	100%	NA	NA	1000 non-zeros 0 zeros 3464@0.008 ppm *n=19*		
Kale	cooked, boiled, canned	PB	*see broccoli*	1%	NA	NA	5 detects 17523 zeros 1722@0.009 ppm		
Lettuce	Head: uncooked	NB	PDP	31%	NA	NA	1000 non-zeros 3286 zeros 476@0.009 ppm *n=4*		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
	Leafy: uncooked	PB					145 detects 478 zeros 69@0.009 ppm		
	NFS: canned	PB							
Macadamia Nuts	baked	PB	FT	30%	NA	NA	0 detects 14 zeros 6@0.10 ppm		
Melons-*Cantaloupe*	uncooked	NB	PDP	57%	NA	NA	1000 non-zeros 5987 zeros 6936@0.007 ppm *n=4*		
	juice	PB					26 detects 156 zeros 180 @ 0.007 ppm		
Melons-*Honeydew*	uncooked	NB	FDA	58%	19% all melons	75% all melons	Domestic 24 detects 24 zeros 8@0.003 ppm	Import 1000 non-zeros 416 zeros 0@0.003 ppm *n=2*	Combined 1000 non-zeros 515 zeros 0@0.003 ppm *n=2*
Melons-*Watermelon*	uncooked	NB	FDA	15%	19% all melons	75% all melons	Domestic 9 detects 237 zeros 33@0.003 ppm	Import 1000 non-zeros 4263 zeros 0@0.003 ppm *n=2*	Combined 1000 non-zeros 9444 zeros 667@0.003ppm *n=2*
	juice	PB					Domestic 9 detects 237 zeros 33@0.003 ppm	Import 31 detects 134 zeros 0@0.003 ppm	Combined 40 detects 377 zeros 27@0.003 ppm
Melons-*Other*	uncooked	NB	*see honeydew*	58%	19% all melons	75% all melons	Domestic 24 detects 24 zeros 8@0.003 ppm	Import 1000 non-zeros 416 zeros 0@0.003 ppm *n=2*	Combined 1000 detects 515 zeros 0@0.003 ppm *n=2*
Mustard Greens	boiled	PB	*see spinach*	17%	NA	NA	216 detects 1206 zeros 32@0.006		
Mustard Seed	uncooked, cooked, frozen	B	Tolerance	100%	NA	NA	0.2		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
Nectarines	uncooked	NB	*see peaches*	4%	NA	NA	69 detects 4416 zeros 115@0.007 ppm		
Oats	uncooked, cooked, baked, boiled, fried, canned	B (no detectable residues)	*see wheat*	1%	NA	NA	0.0001		
Peas-*Succulent*	uncooked, cooked, baked, boiled, fried	PB	FDA	4%	67%	9%	<u>Domestic</u> 43 detects 954 zeros 0@0.003 ppm	<u>Import</u> 274 detects 345 zeros 425@0.003ppm	<u>Combined</u> 317 detects 1748 zeros 0@0.003 ppm
	canned		PDP		NA	NA	6 detects 715 zeros 24@0.007 ppm		
	frozen		PDP				0 detects 674 zeros 28@0.007 ppm		
Peaches	uncooked, cooked, baked, boiled	NB	PDP	17%	NA	NA	1000 non-zeros 13158 1695@0.007 ppm *n=21*		
	frozen, dried, juice	PB					69 detects 895 zeros 115@0.007 ppm		
	canned		PDP				1 detect 629 zeros 128@0.006 ppm		
Pears	uncooked, cooked, baked, boiled	NB	PDP	48%	NA	NA	1000 non-zeros 18874 zeros 16423@0.008 ppm *n=13*		
	canned, dried,	PB					37 detects Pecansuncooked, baked, boiledPBsee filbert 18%NANA0 detects 27 zeros 6@0.1 ppm		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
Peppers-*Hot*	uncooked, cooked, baked, boiled, fried	NB	FDA	12%	24% all peppers	25% all peppers	Domestic 3 detects 59 zeros 5@0.003 ppm	Import 1000 non-zeros 4078 zeros 288@0.003ppm *n=202*	Combined 1000 non-zero 4558 zeros 69@0.003 ppm *n=202*
	canned, frozen, cured	PB					Domestic 3 detects 59 zeros 5@0.003 ppm	Import 235 detects 958 zeros 68@0.003 ppm	Combined 238 non-zero 1076 zeros 16@0.003 ppm
Peppers-*Other*	uncooked	NB	*see peppers-sweet*	17%	24% all peppers	25% all peppers	Domestic 1000 non-zeros 7081 zeros 661@0.003 ppm *n=76*	Import 1000 non-zeros 4823 zeros 523@0.003ppm *n=76*	Combined 1000 non-zero 5570 zeros 141@0.003ppm
Peppers-*Sweet*	uncooked, cooked, baked, boiled	NB	FDA	19%	24% all peppers	25% all peppers	Domestic 1000 non-zeros 7081 zeros 661@0.003 ppm *n=76*	Import 1000 non-zeros 4823 zeros 523@0.003ppm *n=76*	Combined 1000 non-zero 5436 zeros 275@0.003ppm *n=76*
	canned, frozen, cured	PB					Domestic 32 detects 220 zeros 19@0.003 ppm	Import 178 detects 863 zeros 95@0.003ppm	Combined 210 non-zero 1140 zeros 57@0.003 ppm
Pineapples	uncooked, cooked, canned, frozen, dried, juice	NB	FDA	6%	33%	85%	Domestic 0 detects 55 zeros 7@0.003 ppm	Import 2 detects 84 zeros 2@0.003ppm	Combined 2 non-zero 172 zeros 21@0.003 ppm
Plums	uncooked, cooked	NB	FDA	12%	4%	16%			
	canned, frozen, cured	PB							
	dried	PB		4%			Domestic 0 detects 58 zeros 4@0.003 ppm	Import 2 detects 84 zeros 2@0.003ppm	Combined 2 non-zero 552 zeros 21@0.003 ppm
Potatoes	cooked, baked, boiled, fried	NB	PDP	16%	NA	NA	1000 non-zeros 5325 zeros 14@0.009 ppm *n=19*		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
	canned, frozen	PB					221 detects 1177 zeros 3@0.009 ppm		
	dried	B					0.0016		
Potatoes-*Sweet*	cooked, baked, boiled, fried	NB	PDP	46%	NA	NA	25 detects 842 zeros 694@0.008 ppm		
	canned	PB							
Pumpkins	cooked, baked, boiled, fried	NB	*see cucumber*	36%	19% all melons	75% all melons	<u>Domestic</u> 1000 non-zeros 4431 zeros 1492 @0.003 ppm *n=30*	<u>Import</u> 1000non-zeros 1310 zeros 0@0.003ppm *n=30*	<u>Combined</u> 1000 non-zero 1778 zeros 0@0.003 ppm
	canned	PB					<u>Domestic</u> 41 detects 173 zeros 58@0.003 ppm	<u>Import</u> 197 detects 258 zeros 0@ 0.003ppm	<u>Combined</u> 237 non-zero 420 zeros 0@0.003 ppm
Raspberries	uncooked, baked, boiled, canned, and frozen	PB	FDA	1%	<1%	11%	<u>Domestic</u> 1 detects 108 zeros 0@0.003 ppm	<u>Import</u> 5 detects 454 zeros 0@0.003 ppm	<u>Combined</u> 6 detects 562 zeros 0@0.003ppm
Rye	baked, cooked	B (no detectable residues)	*see wheat*	1%	NA	NA	0.0001		
Spinach	uncooked, cooked, boiled, frozen	PB	PDP	11%	NA	NA	215 detects 1999 zeros 32@0.006 ppm		
	canned		PDP				0 detects 150 zeros 18@0.007 ppm		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)		
Squash-*Summer*	uncooked, cooked, baked, boiled, fried	NB	FDA	84%	19% all melons	75% all melons	<u>Domestic</u> 1000 non-zeros 612 zeros 2215@ 0.003 ppm *n=46*'	<u>Import</u> 1000non-zeros 728 zeros 0@0.003ppm *n=46*'	<u>Combined</u> 1000non-zeros 348 zeros 826@0.003ppm *n=46*
	canned, frozen, cured	PB					<u>Domestic</u> 87 detects 53 zeros 193@0.003 ppm	<u>Import</u> 368 detects 268 zeros 0@0.003ppm	<u>Combined</u> 452 detects 155 zeros Squash-*Winter*uncooked, cooked, baked, boiled, friedNBPDP 84%NANA1000 non-zeros 724 zeros 2801@0.009 ppm *n=76*
Strawberries	uncooked, cooked,	PB	PDP	21%	NA	NA	38 detects CommodityFood FormsCommodity ClassificationData SourceDomestic Max%CTImport %CT% of Commodity ImportedAcute AR or Residue Distribution File (RDF)		
Sugarcane	baked, refined	B	Tolerance	1%	NA	NA	0.005		
Tea	cooked	B	FT w/PF	100%	NA	NA	0.004		
Tomatoes	uncooked, cooked, baked, boiled, fried	NB	PDP	29%	NA	NA	1000 non-zeros 3169 zeros 295@0.008 ppm *n=19*		
	frozen, canned, dried, catsup, juice, paste, puree	PB		4%			187 detects 647 zeros 0@0.008 ppm		
Turnip Greens	boiled, canned, frozen, fermented	PB	*see spinach*	6%	NA	NA	216 detects 3870 zeros 32@0.006 ppm		
Walnuts	uncooked, cooked, baked	PB	*see almond*	1%	NA	NA	22 detects 2200 zeros 0@0.10 ppm		

Commodity	Food Forms	Commodity Classification	Data Source	Domestic Max%CT	Import %CT	% of Commodity Imported	Acute AR or Residue Distribution File (RDF)
	oil	B					0.0036
Wheat	uncooked, cooked, baked, boiled, fried, canned, frozen, cured	B	PDP	1%	NA	NA	0.0001